Stk # 41754
~~Hampton~~ $349.00
HENRY MANN
215-355-7200

HL600

INTEGRATED THERMOMETER

Anritherm

ANRITSU METER CO.,LTD

W A R R A N T Y

The ANRITSU METER CO., LTD. warrants each instrument it manufactures to be free from defects in material and workmanship under normal use and service for the period of one year from date of purchase. This warranty extends only to the original purchaser and does not apply to any instrument which has been subject to misuse, accident, or abnormal operating conditions. Disposable batteries are not covered under this warranty.

All requests for repairs and replacement parts should be directed to the ANRITSU METER CO., LTD. or the nearest ANRITSU representative in your area.
Please indicate the model and serial number giving full details of the problem encountered.

© Copyright 1986 by ANRITSU METER CO., LTD.
All rights reserved.

PREFACE

This manual provides complete operating and maintenance instructions for the HL600 digital thermometer.

Reader's Guide

This manual is organized into 9 sections.

SECTION 1, INTRODUCTION AND SPECIFICATIONS, provides a brief description and specifications of the HL600.

SECTION 2, OPERATING INSTRUCTIONS, provides complete operating instructions.

SECTION 3, MEASUREMENT TUTORIAL, provides considerations and techniques to help you use the HL600 effectively.

SECTION 4, THEORY OF OPERATION, provides an overall functional description of the HL600.

SECTION 5, MAINTENANCE, provides maintenance information for the HL600.

SECTION 6, LIST OF REPLACEABLE PARTS, provides an illustrated replaceable parts list for HL600.

SECTION 7, INTERCHANGEABLE THERMOCOUPLE PROBES, provides brief introduction of ANRITSU standard probes which are selected from 300 kinds of standard probe series.

SECTION 8, INDEX

CONTENTS

SECTION 1
INTRODUCTION AND SPECIFICATIONS

Introduction	1-1
About This Model	1-1
Accessories and Option	1-1
Specifications	1-1
Names of Component	1-3

SECTION 2
OPERATING INSTRUCTIONS

Introduction	2-1
Unpacking and Repacking	2-1
Battery Installation	2-1
Battery Level Indication	2-2
Other Power Sources	2-3
Probe Installation	2-3
Power On	2-4
Illuminator On	2-5
Overrange Indication	2-5
Burnout Indication	2-5
Centigrade/Fahrenheit	2-5
Hold	2-6
Peak Valley Hold	2-6
Average	2-6
Resolution	2-6

SECTION 3
MEASUREMENT TUTORIAL

Introduction	3-1
Surface Temperature	3-1
Liquid Temperature	3-2
Gas (Air) Temperature	3-3
Solid Temperature	3-3

SECTION 4
THEORY OF OPERATION

Introduction	4-1

Seebeck Effect 4-1
Equivalent Circuit 4-1
Architecture 4-2
Block Diagram 4-2
Auto-zero 4-2
Auto-fullscale 4-2
Digital Linearization 4-4
Scan Timing 4-4
Peak Valley Hold 4-5
Average 4-5

SECTION 5
MAINTENANCE
Introduction 5-1
Recommended Equipment 5-1
Performance Test 5-1
Calibration Test 5-4
Reference Table 5-5

SECTION 6
LIST OF REPLACEABLE PARTS
Replaceable parts list 6-1

SECTION 7
INTERCHANGEABLE THERMOCOUPLE PROBES
Standard Surface Probes 7-1
Moving Surface Probes 7-2
Penetration Probe 7-2
Air (Gas) Probe 7-3
Flat Leaf Probe 7-3
Oil Tank Probe 7-3
Soldering Iron Probe 7-3
Heavy Duty Surface Probe 7-3

SECTION 8
INDEX 8-1

INTRODUCTION AND SPECIFICATIONS

Introduction

The HL600 handheld digital thermometer is a high-performance multi-function instrument designed for general purpose bench applications.

About This Model

The HL600 presents these superior features;

- 0.1% of reading accuracy
- 0.1°C/0.1°F resolution
- Highly legible multi-data display
- Luminous liquid crystal display
- Self-calibration (Auto-zero and quto-fullscale)
- Advanced functions
  Hold, Average, Peak and Valley Hold.

Accessories and Option

The accessories include;

- Rugged protective case
- 4 pcs of batteries

The option include;

- An ac power adaptor

Specifications

1. Temperature Range

■ HL600K	-200 to 1200°C	(-100.0 to 500.0°C/0.1°C)
(Type K)	-328 to 2192°F	(-148.0 to 932.0°F/0.1°F)
■ HL600E	-200 to 800°C	(-100.0 to 500.0°C/0.1°C)
(Type E)	-328 to 1472°F	(-148.0 to 932.0°F/0.1°F)
■ HL600J	-200 to 700°C	(-100.0 to 500.0°C/0.1°C)
(Type J)	-328 to 1292°F	(-148.0 to 932.0°F/0.1°F)

Digitized by the Internet Archive
in 2025

https://archive.org/details/manualsplus_06158

OPERATING INSTRUCTIONS

Introduction

This section describes how to make measurements with your HL600. Please take time to read this manual carefully so that you can take full advantage of the wide variety of measurement functions offered by the HL600.

Unpacking and Repacking

Your instrument was shipped with;

- 4 pcs of 1.5V battery
- A rugged protective case
- This manual

Contact the place of purchase if anything is missing or damaged in shipment.

Please use the original container if reshipment is necessary.
If the original container is not available, the instrument should be carefully wrapped with shock-absorbing material.

Battery Installation

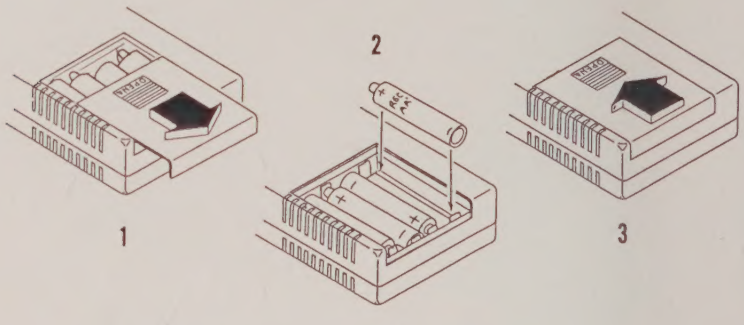
The HL600 is designed to operate on four 1.5V batteries.

When you receive the instrument, the batteries will not be installed. Once the batteries are installed, you can expect a typical operating life of up to 100 hours with carbon-zinc batteries or 150 hours with alkaline batteries.

[NOTE]
The set cannot be operated on the internal batteries when either the ac power adaptor or battery pack is connected to the set.

[NOTE]
In very cold conditions (ambient temperature below 5°C), alkaline batteries are recommended.

Use the following procedure to install or replace the four 1.5V batteries:



1 Remove the battery compartment cover.
2 Set four 1.5V batteries ("AA"(R6))
3 Close the battery compartment cover.

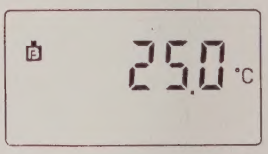
[CAUTION]
When the set is not to be used for a long period of time or is to be operated extensively on other power sources, remove the batteries to avoid damage to the set caused by battery leakage and corrosion.

Battery Level Indication

When the battery has exhausted about 80% of its useful life the indicator will appear at the far left of the display. Your instrument will continue to operate properly for at least 24 hours with alkaline batteries after first appears on the display.

In this case, replace the batteries.

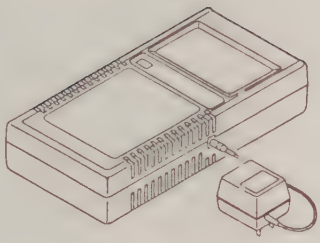
If the batteries are completely exhausted, no indicator will be displayed.



Other Power Sources

■ HOUSE CURRENT

Use the ac power adaptor.
First connect the adaptor to the dc 6V jack, then plug the adaptor into outlet.

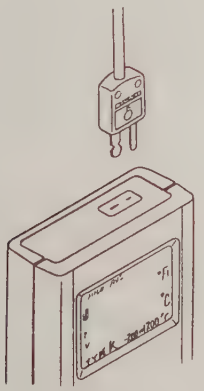


■ BATTERY PACK

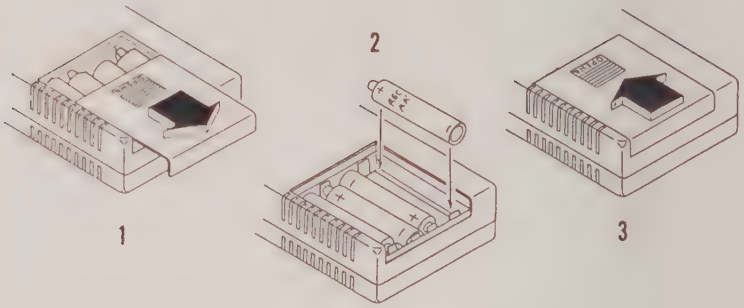
First connect the battery pack to the instrument dc 6V jack, and then turn on the power switch.

Probe Installation

Insert a suitable type of thermocouple probe to the input jack. The thermocouple type is indicated below the display.



Use the following procedure to install or replace the four 1.5V batteries:



1 Remove the battery compartment cover.
2 Set four 1.5V batteries ("AA"(R6))
3 Close the battery compartment cover.

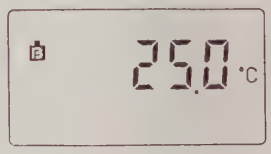
[CAUTION]
When the set is not to be used for a long period of time or is to be operated extensively on other power sources, remove the batteries to avoid damage to the set caused by battery leakage and corrosion.

Battery Level Indication

When the battery has exhausted about 80% of its useful life the indicator will appear at the far left of the display. Your instrument will continue to operate properly for at least 24 hours with alkaline batteries after first appears on the display.

In this case, replace the batteries.

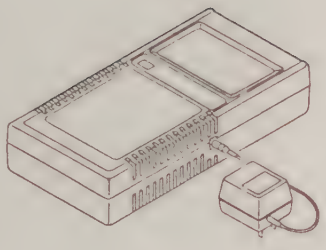
If the batteries are completely exhausted, no indicator will be displayed.



Other Power Sources

■ HOUSE CURRENT

Use the ac power adaptor.
First connect the adaptor to the dc 6V jack, then plug the adaptor into outlet.

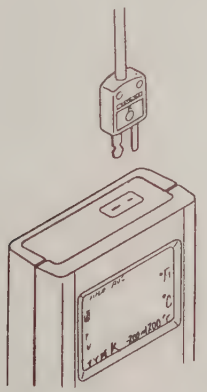


■ BATTERY PACK

First connect the battery pack to the instrument dc 6V jack, and then turn on the power switch.

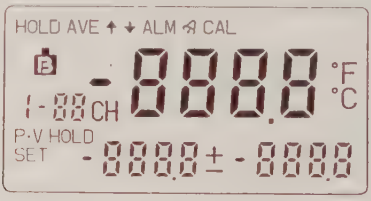
Probe Installation

Insert a suitable type of thermocouple probe to the input jack. The thermocouple type is indicated below the display.



Power On

Turn the power switch ON. The HL600 will automatically perform a self-test to make sure the display and microprocessor are functioning properly. If normal, all the LCD segments in the display will turn on and one or two seconds later, the instrument will cause a short beep before the measurement start.



If the LCD segments do not all turn on during the self-test, or if the instrument does not respond to key operations after the self-test, something is probably wrong with the instrument. Try the test again, check the batteries, and if it fails, contact the place of purchase.

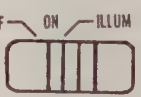
[CAUTION]

If you turn off your instrument and then immediately turn it back on, a randaom assortment of LCD segments may be displayed. In this case, turn the instrument off and waiting at least three seconds before switching it on again.

■ Power Switch

Power Off

Power On



Power and illuminator On

[NOTE]

Three kinds of temperature are displayed at the same time on the multi-data display.

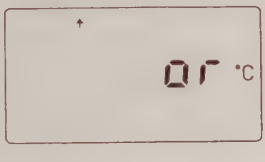
For more information, refer to Peak Valley Hold.

Illumunator On

Turn the power switch ILLUM, the LED plate behind the LCD display will illuminate. When on, the illumination uses three times the battery power as opposed to normal operation without illumination.

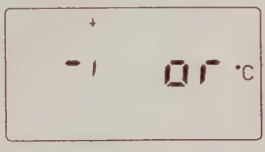
Overrange Indicator

If the "or" symbol appears on the display during the measurement, this means that the measuring temperature is out of the range.



If the temperature is higher than the highest level of the range, "or" and "↑" will be displayed.

If lower than the lowest level of range "-or" and "↓" will be displayed.

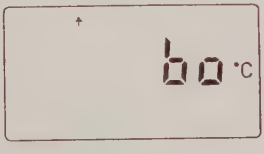


[NOTE]

These symbols do not necessarily mean that the instrument is being exposed to a damaging input condition.

Burnout Indicator

If "bo" and "↑" symbol appears on the display, the connected probe is probably broken or a probe is not connected to the input jack.

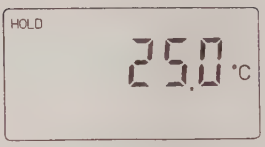


°C/°F Centigrade/Fahrenheit

Centigrade (°C) or fahrenheit (°F) can be selected by pressing °C/°F key.

HOLD Hold

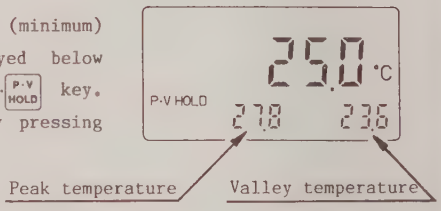
The reading of measuring temperature can be held by pressing HOLD key.
This mode can be released by pressing the HOLD key again.



[NOTE]

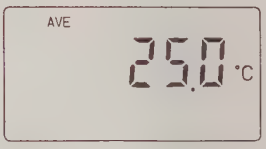
P·V HOLD Peak Valley Hold

Peak (maximum) and Valley (minimum) temperatures can be displayed below the main reading by pressing P·V HOLD key.
This mode can be released by pressing the P·V HOLD key again.



AVE Average

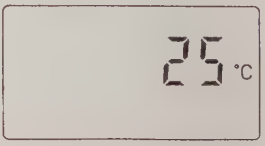
Averaged temperature of every 10 scans can be displayed by pressing AVE key.
This mode can be released by pressing the AVE key again.



[NOTE]
Peak and valley readings are averaged in the P V Hold mode.

1/0.1 Resolution

Resolution (1 degree or 0.1 degree) can be changed 0.1 to 1 or 1 to 0.1 by pressing 1/0.1 key.



MEASUREMENT TUTORIAL

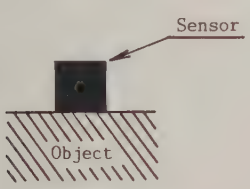
Introduction

This section provides considerations and techniques to help you make precise temperature measurements.
The most accurate temperature measurements start with the selection of the proper probe. We have many kinds of instruments to support various applications in addition to a variety of more than 300 Standard Plug-in Interchangeable Sensors.

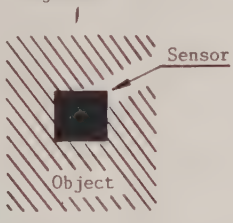
There are the vast number of possible objects to measure can be divided into the four types; surface, liquid, gas and solid.

Surface Temperature

Surface temperature measurement is very difficult and different from the liquid and gas(air) measurements. In case of the gas and liquid measurements the sensors are surrounded by the objects.

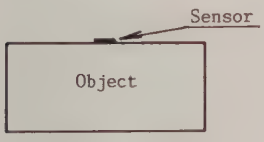


Surface

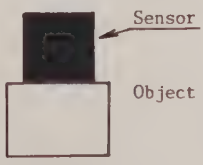


Liquid and Gas(Air)

■ The mass of the sensor should be small in relation to the mass of the part being measured.



Good

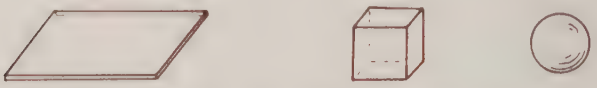


Poor

■ The mass of the sensor should be small in relation to the material (Thermal resistance) of the part being measured.

For example, the thermo resistance of iron is smaller than plastic, glass, and rubber.
Smaller sensor provides a better measurement when the material has a large thermo resistance such as plastic.

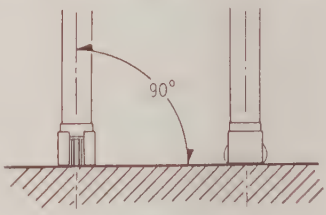
■ The contacting area of the sensor is big in relation to the mass of the sensor.



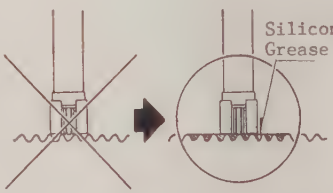
1	Mass	1	1
Greater than 100	Contacting Area	1	Less than 0.001

■ How to use

ANRITSU surface probes are designed to be pressed perpendicular to the surface.



If the surface is not smooth and flat, good thermal contact can not be expected. In this case apply silicon grease to the material surface.



If the surface is moving, use ANRITSU probes designed for moving and rotating surfaces probes.
For more details, see our catalog.

Liquid Temperature

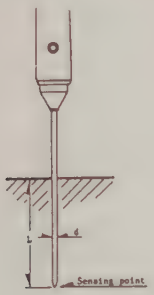
Obtaining liquid temperature measurements are much easier than surface temperature measurements. But there are still important things

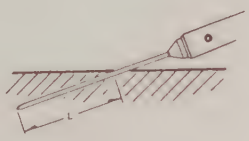
that should be kept in mind.

- The mass of the sensor should be small in relation to the mass of the liqid being measured.

- The inserted depth of seath type probe should be longer than 17 X Diameter of seath.

$$L = 17 \times d$$



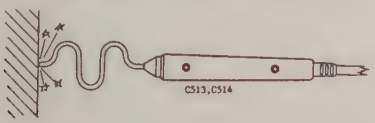


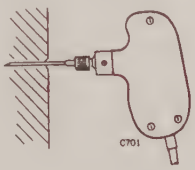
Gas (Air) Temperature

The thermo resistance of the gas is very big. Air is good for heat-insulator. If the gas is very static, response time of the probe will be delayed. If you want to obtain a quick reading, shake the probe head.

Solid Temperature

If the object is a semi-solid material, you can use the same probe as you would use for liquid measurements. But if it is hard material, sensor top should be very hard structure.





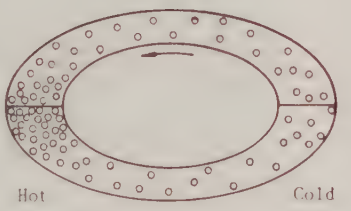
THEORY OF OPERATION

Introduction

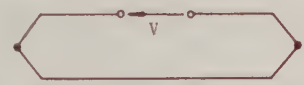
This section provides an overall functional description of this model and temperature probe.

Seebeck Effect

When two dissimilar metalic conductors are joined end to end and one of the ends is heated, produces a thermoelectric voltage in the circuit of which they form a part. Thomas Seebeck made this discovery in 1821.



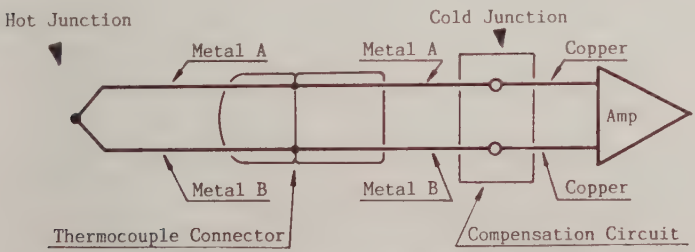
The most common combinations of two metalic conductors are listed in the following table.



TYPE K (CA)	Chromel-Almel
TYPE E (CRC)	Chromel-Constantan
TYPE J (IC)	Iron-Constantan
TYPE T (CC)	Copper-Constantan

Equivalent Circuit

An equivalent of the Seebeck Circuit is used on ANRITSU thermometers.



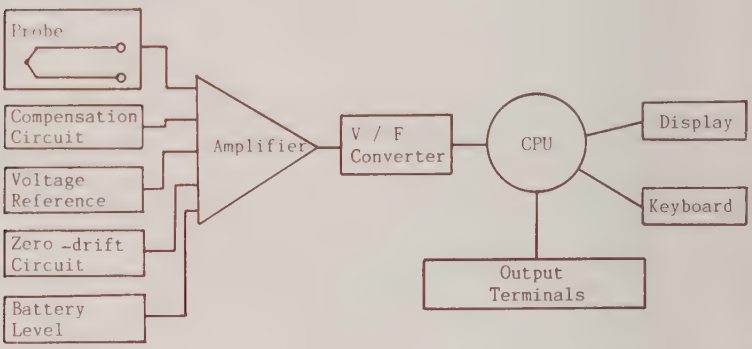
The combination of compensation voltage and the reference junction voltage is equal to the voltage of a 0°C cold junction.
And the voltage is referenced to 0°C, and be linearized and converted to temperature by using the NBS table.

Architecture

The major architecture of this model is shown in block diagram.

1) The 4-bit microprocessor senses the key operations.
2) The microprocessor controls the input terminals, output terminals, and the v/f converter.
3) The miroprocessor vonverts the voltage to temperature, considering cold junction compensator, zero-drift, and fullscale-error.
4) The microprocessor displays and outputs the results.

Block Diagram



Auto-zero

If you have an old type weighing machine, you probably adjust the scale to zero before you weigh an object. The error called "zero-drift" which is also caused on electrical measuring instruments.

The microprocessor memorizes the value of zero-drift and then eliminates it automatically.

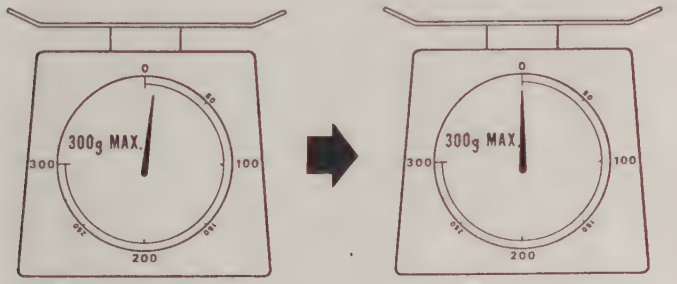
Auto-fullscale

Most weighing machines indicate a wrong weight when you use it many times or environment is changed.
The microprocessor senses the precise voltage reference and checks

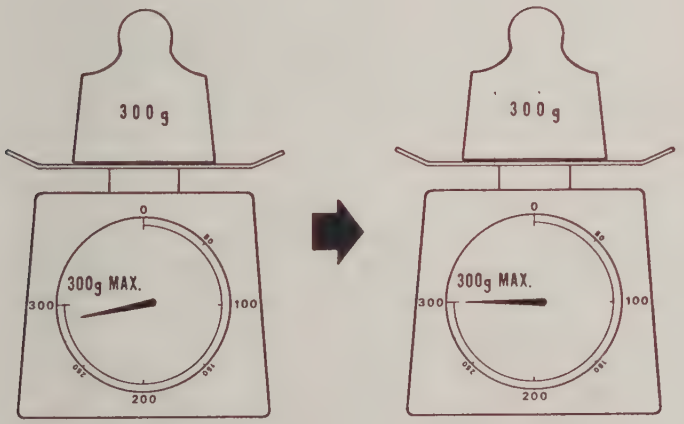
its fullscale.

The combination of the auto-zero and auto-fullscale introduces the most stable and accurate measurement.
We call this function Self-calibration.

■ Auto-zero



■ Auto-fullscale



Digital Linearization

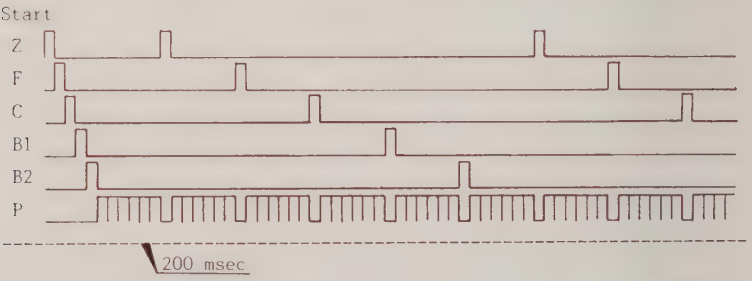
The temperature-versus-voltage relationship of the thermocouple is not linear. The thermocouple curve had been linearized by a combination of different gain amplifiers. This is called Analog (Hardware) linearization. They have been linearized by software routines stored in the microprocessor memory.
This is called Digital (Software) linearization.

The thermocouple characteristic curve is divided into 37 sectors and each sector is approximated by a linear curve.

Scan Timing

The microprocessor senses the all conditions (zero, fullscale, compensator, battery) before sensing by the probe when the power is turned on. After the first cycle each condition is sensed once for every six probe scans.

■ Timing Chart



Z : Auto-zero, F : Auto-fullscale, C : Cold junction compensator
B1: Battery 1 B2: Battery 2 P : Probe

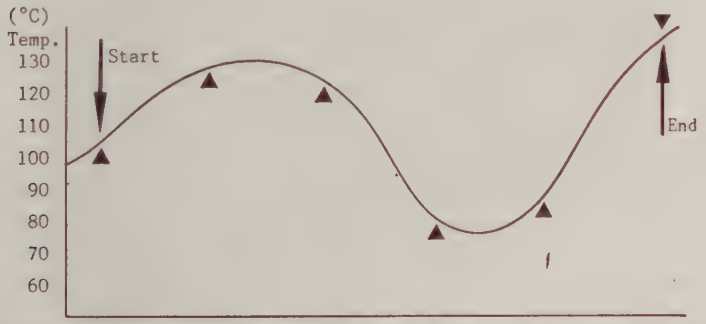
This scanning is started after the self-test mode.

■ Voltage/Frequency Converter

The v/f converter converts the input voltage to the frequency.

Peak Valley Hold

The peak hold valley hold function is very useful for the precise measurement of unstable objects. This is because peak (maximum) temperature provides the best data during an unstable measurement when the object temperature is higher than room temperature, and valley (minimum) temperature is the best data when the object temperature is lower than room temperature.

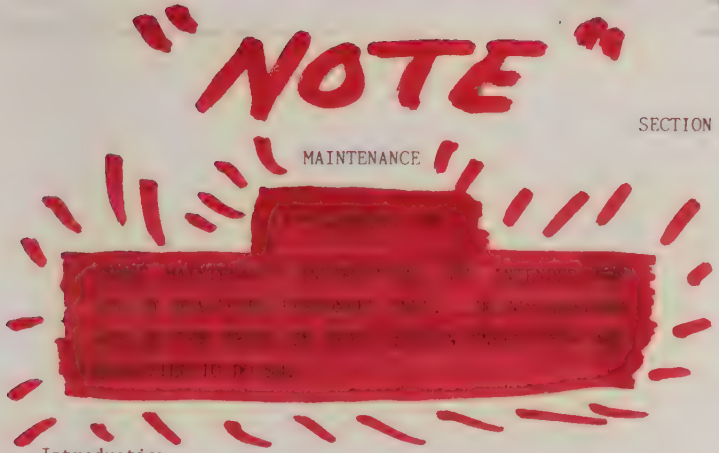


Peak	104.8	128.3	130.2	130.2	130.2	137.6
Valley	104.8	104.8	104.8	81.0	76.9	76.9

Average

The temperature on the display in the AVE mode is averaged every 10 temperatures which are scaned every 200 msec.

This mode is usefull when the reading changes too fast to read.



MAINTENANCE

Introduction

This section provides maintenace information for this model and includes a performance test and a calibration test.

Test equipment recommended for the calibration test and performance test is listed below. If the recommended equipment is not available, equipment that neets the indicated minimum specifications may be substituted.

Recommended Equipment

DC Voltage Standard	YEW (YOKOGAWA HOKUSHIN ELECTRIC) Model 2553 DC VOLTAGE STANDARD 1 micro-volt resolution ±0.02% accuracy
Calibration Probe	ANRITSU Calibration Probe Model C513-H

Performance Test

This test compare the performance of this model with the specifications given in the Specifications SECTION 1. The test is recommended as an acceptance test when the instrument is first received.

To ensure optimum performance, the test must be performed at an ambient temperature between 20°C to 30°C (68°F to 86°F), with a relative humidity of less than 75%. The instrument should be allowed to warm up for 3 minutes prior to beginning any test.

■ Preparation for Test

The following conditions should be checked before the performance test.

1) Environmental conditions

Temperature ; 20°C to 30°C (68°F to 86°F)

Humidity ; Less than 75% R.H.

2) Absence of a noise source near the test area.

3) The battery level indicator of the instrument is not displayed.

■ Display Test

Turn on the power, then all the LCD segments in the display will turn on (Self Test mode) and the instrument will be in a measurement mode. For more details, refer to the Power On in the SECTION 2.

■ Key Board Test

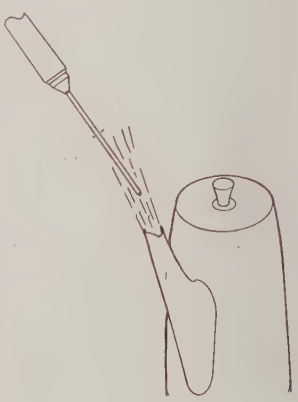
Refer to the each key function in SECTION 2.

■ Fixed Point Test

Testing the boiling point of water is very simple fixed point test with a reliable temperature source.

1) Connect the Calibration Probe to the input jack and measure the steam temperature.

2) The steam temperature is approx. 100°C, however the precise boiling temperature depends on atmospheric pressure during the test. Refer to the boiling temperature table on page 5-3 for the boiling point.



Use 100% pure water (distilled water) and refer to the table below to compare the results of the test. The Centigrade and Fahrenheit conversion formula is shown in below the table.

Boiling Point of Water

$$(°C) = 100.0 + 0.0367(P-760) - 0.000023(P-760)^2$$

P(mmHg) : Atmospheric pressure

Boiling Temperature Table

P	0	1	2	3	4	5	6	7	8	9
600	93.5	93.6	93.6	93.7	93.7	93.8	93.8	93.8	93.9	93.9
610	94.0	94.0	94.1	94.1	94.2	94.2	94.2	94.3	94.3	94.4
620	94.4	94.5	94.5	94.5	94.6	94.6	94.7	94.7	94.8	94.8
630	94.8	94.9	94.9	95.0	95.0	95.1	95.1	95.1	95.2	95.2
640	95.3	95.3	95.3	95.4	95.4	95.5	95.5	95.6	95.6	95.6
650	95.7	95.7	95.8	95.8	95.9	95.9	95.9	96.0	96.0	96.1
660	96.1	96.1	96.2	96.2	96.3	96.3	96.3	96.4	96.4	96.5
670	96.5	96.6	96.6	96.6	96.7	96.7	96.8	96.8	96.8	96.9
680	96.9	97.0	97.0	97.0	97.1	97.1	97.2	97.2	97.2	97.3
690	97.3	97.4	97.4	97.4	97.5	97.5	97.6	97.6	97.6	97.7
700	97.7	97.8	97.8	97.8	97.9	97.9	98.0	98.0	98.0	98.1
710	98.1	98.1	98.2	98.2	98.3	98.3	98.3	98.4	98.4	98.5
720	98.5	98.5	98.6	98.6	98.6	98.7	98.7	98.8	98.8	98.8
730	98.9	98.9	99.0	99.0	99.0	99.1	99.1	99.1	99.2	99.2
740	99.3	99.3	99.3	99.4	99.4	99.4	99.5	99.5	99.6	99.6
750	99.6	99.7	99.7	99.7	99.8	99.8	99.9	99.9	99.9	100.0
760	100.0	100.0	100.1	100.1	100.1	100.2	100.2	100.3	100.3	100.3
770	100.4	100.4	100.4	100.5	100.5	100.5	100.6	100.6	100.7	100.7
780	100.7	100.8	100.8	100.8	100.9	100.9	100.9	101.0	101.0	101.0
790	101.1	101.1	101.2	101.2	101.2	101.3	101.3	101.3	101.4	101.4
800	101.4	101.5	101.5	101.5	101.6	101.6	101.6	101.7	101.7	101.7

Unit : °C

°C and °F Conversion Formula

$$[°F] = 1.8 \times [°C] + 32$$

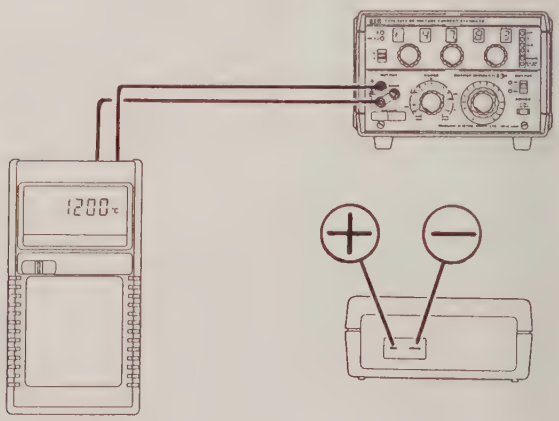
Calibration Test

Connect the dc voltage standard to provide a voltage input to the probe jack instead of thermocouple voltage.

At the first step, connect a short across the input jack and read the display which is cold junction temperature.
Usually this cold junction temperature is almost the same as ambient (room) temperature.

For each step in Reference Table (see page 5-5) set the dc voltage standard for the specified input voltage and verify that the error of display reading is within the accuracy written in the specifications.

■ Connections for dc voltage standard



[CAUTION]

Do not turn on both instruments while connecting the voltage standard to the digital thermometer.

Voltage input should not exceed 100mV.

Reference Tables

Please note that the thermocouple voltage table in this section supersede N.B.S. circular #561.

■ Thermocouple types

Type K = Nickel-Chromium Vs. Nickel-Aluminum
Type E = Nickel-Chromium Vs. Copper-Nickel
Type J = Iron Vs. Copper-Nickel

■ How to read the reference tables.

Ambient (room) temperature
(Temperature of Reference junction)

	19	20	21	22	23	24
-200	-6.577	-6.617	-6.657	-6.698	-6.738	-6.779
-150	-5.670	-5.710	-5.750	-5.791	-5.831	-5.872
-100	-4.311	-4.351	-4.391	-4.432	-4.472	-4.513
-50	-2.647	-2.687	-2.727	-2.768	-2.808	-2.849
0	-0.758	-0.798	-0.838	-0.879	-0.919	-0.960
50	1.264	1.224	1.184	1.143	1.103	1.062
100	3.337	3.297	3.257	3.216	3.176	3.135

Thermocouple probe generates 3.297 mV when measuring temp. is 100°C and room temp. is 20°C.

THermocouple voltages : Room Temp.= 19°C
(Reference junction at 19°C)

Calibrating Temperature

Nickel-Chromium Vs. Nickel-Aluminum

K

	19	20	21	22	23	24	25	26	27	28	29	30
-200	-6.577	-6.617	-6.657	-6.698	-6.738	-6.779	-6.819	-6.860	-6.900	-6.941	-6.981	-7.022
-150	-5.630	-5.671	-5.712	-5.753	-5.791	-5.831	-5.872	-5.912	-5.953	-5.993	-6.034	-6.074	-6.115
-100	-4.621	-4.661	-4.701	-4.741	-4.782	-4.822	-4.863	-4.903	-4.943	-4.984	-5.024	-5.064	-5.105
-50	-3.554	-3.594	-3.634	-3.674	-3.715	-3.755	-3.795	-3.835	-3.875	-3.915	-3.955	-3.995	-4.035
0	-2.431	-2.471	-2.512	-2.552	-2.592	-2.632	-2.672	-2.712	-2.752	-2.792	-2.832	-2.872	-2.912
50	-1.254	-1.294	-1.334	-1.374	-1.414	-1.454	-1.494	-1.534	-1.574	-1.614	-1.654	-1.694	-1.734
100	0.023	-0.017	-0.057	-0.098	-0.138	-0.179	-0.219	-0.260	-0.300	-0.341	-0.381	-0.422	-0.462
150	1.284	1.244	1.204	1.163	1.123	1.082	1.042	1.001	0.961	0.920	0.880	0.839	0.799
200	2.587	2.547	2.507	2.466	2.426	2.385	2.345	2.304	2.264	2.223	2.183	2.142	2.102
250	3.935	3.895	3.855	3.814	3.774	3.733	3.693	3.652	3.612	3.571	3.531	3.490	3.450
300	5.327	5.287	5.247	5.206	5.166	5.125	5.085	5.044	5.004	4.963	4.923	4.882	4.842
350	6.763	6.723	6.683	6.642	6.602	6.561	6.521	6.480	6.440	6.399	6.359	6.318	6.278
400	8.243	8.203	8.163	8.122	8.082	8.041	8.001	7.960	7.920	7.879	7.839	7.798	7.758
450	9.767	9.727	9.687	9.646	9.606	9.565	9.525	9.484	9.444	9.403	9.363	9.322	9.282
500	11.334	11.294	11.254	11.213	11.173	11.132	11.092	11.051	11.011	10.970	10.930	10.889	10.849
550	12.945	12.905	12.865	12.824	12.784	12.743	12.703	12.662	12.622	12.581	12.541	12.500	12.460
600	14.599	14.559	14.519	14.478	14.438	14.397	14.357	14.316	14.276	14.235	14.195	14.154	14.114
650	16.296	16.256	16.216	16.175	16.135	16.094	16.054	16.013	15.973	15.932	15.892	15.851	15.811
700	18.035	17.995	17.955	17.914	17.874	17.833	17.793	17.752	17.712	17.671	17.631	17.590	17.550
750	19.815	19.775	19.735	19.694	19.654	19.613	19.573	19.532	19.492	19.451	19.411	19.370	19.330
800	21.636	21.596	21.556	21.515	21.475	21.434	21.394	21.353	21.313	21.272	21.232	21.191	21.151
850	23.496	23.456	23.416	23.375	23.335	23.294	23.254	23.213	23.173	23.132	23.092	23.051	23.011
900	25.395	25.355	25.315	25.274	25.234	25.193	25.153	25.112	25.072	25.031	24.991	24.950	24.910
950	27.331	27.291	27.251	27.210	27.170	27.129	27.089	27.048	27.008	26.967	26.927	26.886	26.846
1000	29.303	29.263	29.223	29.182	29.142	29.101	29.061	29.020	28.980	28.939	28.899	28.858	28.818
1050	31.309	31.269	31.229	31.188	31.148	31.107	31.067	31.026	30.986	30.945	30.905	30.864	30.824
1100	33.347	33.307	33.267	33.226	33.186	33.145	33.105	33.064	33.024	32.983	32.943	32.902	32.862
1150	35.414	35.374	35.334	35.293	35.253	35.212	35.172	35.131	35.091	35.050	35.010	34.969	34.929
1200	37.508	37.468	37.428	37.387	37.347	37.306	37.266	37.225	37.185	37.144	37.104	37.063	37.023
1250	39.626	39.586	39.546	39.505	39.465	39.424	39.384	39.343	39.303	39.262	39.222	39.181	39.141
1300	41.765	41.725	41.685	41.644	41.604	41.563	41.523	41.482	41.442	41.401	41.361	41.320	41.280
1350	43.922	43.882	43.842	43.801	43.761	43.720	43.680	43.639	43.599	43.558	43.518	43.477	43.437
1400	46.093	46.053	46.013	45.972	45.932	45.891	45.851	45.810	45.770	45.729	45.689	45.648	45.608
1450	48.274	48.234	48.194	48.153	48.113	48.072	48.032	47.991	47.951	47.910	47.870	47.829	47.789
1500	50.459	50.419	50.379	50.338	50.298	50.257	50.217	50.176	50.136	50.095	50.055	50.014	49.974
1550	52.643	52.603	52.563	52.522	52.482	52.441	52.401	52.360	52.320	52.279	52.239	52.198	52.158
1600	54.822	54.782	54.742	54.701	54.661	54.620	54.580	54.539	54.499	54.458	54.418	54.377	54.337
1650	56.990	56.950	56.910	56.869	56.829	56.788	56.748	56.707	56.667	56.626	56.586	56.545	56.505
1700	59.142	59.102	59.062	59.021	58.981	58.940	58.900	58.859	58.819	58.778	58.738	58.697	58.657
1750	61.271	61.231	61.191	61.150	61.110	61.069	61.029	60.988	60.948	60.907	60.867	60.826	60.786
1800	63.372	63.332	63.292	63.251	63.211	63.170	63.130	63.089	63.049	63.008	62.968	62.927	62.887
1850	65.438	65.398	65.358	65.317	65.277	65.236	65.196	65.155	65.115	65.074	65.034	64.993	64.953
1900	67.463	67.423	67.383	67.342	67.302	67.261	67.221	67.180	67.140	67.099	67.059	67.018	66.978
1950	69.441	69.401	69.361	69.320	69.280	69.239	69.199	69.158	69.118	69.077	69.037	68.996	68.956
2000	71.365	71.325	71.285	71.244	71.204	71.163	71.123	71.082	71.042	71.001	70.961	70.920	70.880
2050	73.230	73.190	73.150	73.109	73.069	73.028	72.988	72.947	72.907	72.866	72.826	72.785	72.745
2100	75.030	74.990	74.950	74.909	74.869	74.828	74.788	74.747	74.707	74.666	74.626	74.585	74.545
2150	76.760	76.720	76.680	76.639	76.599	76.558	76.518	76.477	76.437	76.396	76.356	76.315	76.275
2200	78.414	78.374	78.334	78.293	78.253	78.212	78.172	78.131	78.091	78.050	78.010	77.969	77.929
2250	79.987	79.947	79.907	79.866	79.826	79.785	79.745	79.704	79.664	79.623	79.583	79.542	79.502
2300	81.473	81.433	81.393	81.352	81.312	81.271	81.231	81.190	81.150	81.109	81.069	81.028	80.988
2350	82.866	82.826	82.786	82.745	82.705	82.664	82.624	82.583	82.543	82.502	82.462	82.421	82.381
2400	84.160	84.120	84.080	84.039	83.999	83.958	83.918	83.877	83.837	83.796	83.756	83.715	83.675
2450	85.350	85.310	85.270	85.229	85.189	85.148	85.108	85.067	85.027	84.986	84.946	84.905	84.865
2500	86.430	86.390	86.350	86.309	86.269	86.228	86.188	86.147	86.107	86.066	86.026	85.985	85.945
2550	87.394	87.354	87.314	87.273	87.233	87.192	87.152	87.111	87.071	87.030	86.990	86.949	86.909
2600	88.236	88.196	88.156	88.115	88.075	88.034	87.994	87.953	87.913	87.872	87.832	87.791	87.751
2650	88.950	88.910	88.870	88.829	88.789	88.748	88.708	88.667	88.627	88.586	88.546	88.505	88.465
2700	89.529	89.489	89.449	89.408	89.368	89.327	89.287	89.246	89.206	89.165	89.125	89.084	89.044
2750	89.966	89.926	89.886	89.845	89.805	89.764	89.724	89.683	89.643	89.602	89.562	89.521	89.481
2800	90.253	90.213	90.173	90.132	90.092	90.051	90.011	89.970	89.930	89.889	89.849	89.808	89.768
2850	90.381	90.341	90.301	90.260	90.220	90.179	90.139	90.098	90.058	90.017	89.977	89.936	89.896
2900	90.340	90.300	90.260	90.219	90.179	90.138	90.098	90.057	90.017	89.976	89.936	89.895	89.855
2950	90.119	90.079	90.039	89.998	89.958	89.917	89.877	89.836	89.796	89.755	89.715	89.674	89.634
3000	89.708	89.668	89.628	89.587	89.547	89.506	89.466	89.425	89.385	89.344	89.304	89.263	89.223

Nickel-Chromium Vs. Copper-Nickel

E

	19	20	21	22	23	24	25	26	27	28	29	30
-200	-9.955	-10.016	-10.076	-10.137	-10.197	-10.258	-10.319	-10.380	-10.441	-10.502	-10.563	-10.625
-150	-8.410	-8.471	-8.531	-8.592	-8.652	-8.713	-8.774	-8.835	-8.896	-8.957	-9.018	-9.080
-100	-6.368	-6.429	-6.489	-6.550	-6.610	-6.671	-6.732	-6.793	-6.854	-6.915	-6.976	-7.038
-50	-3.918	-3.979	-4.039	-4.100	-4.160	-4.221	-4.282	-4.343	-4.404	-4.465	-4.526	-4.588
0	-1.131	-1.192	-1.252	-1.313	-1.373	-1.434	-1.495	-1.556	-1.617	-1.678	-1.739	-1.801
50	1.916	1.855	1.795	1.734	1.674	1.613	1.552	1.491	1.430	1.369	1.308	1.246
100	5.186	5.125	5.065	5.004	4.944	4.883	4.822	4.761	4.700	4.639	4.578	4.516
150	8.656	8.595	8.535	8.474	8.414	8.353	8.292	8.231	8.170	8.109	8.048	7.986
200	12.288	12.227	12.167	12.106	12.046	11.985	11.924	11.863	11.802	11.741	11.680	11.618
300	19.902	19.841	19.781	19.720	19.660	19.599	19.538	19.477	19.416	19.355	19.294	19.232
400	27.812	27.751	27.691	27.630	27.570	27.509	27.448	27.387	27.326	27.265	27.204	27.142
500	35.868	35.807	35.747	35.686	35.626	35.565	35.504	35.443	35.382	35.321	35.260	35.198
600	43.954	43.893	43.833	43.772	43.712	43.651	43.590	43.529	43.468	43.407	43.346	43.284
700	51.969	51.908	51.848	51.787	51.727	51.666	51.605	51.544	51.483	51.422	51.361	51.299
800	59.891	59.830	59.770	59.709	59.649	59.588	59.527	59.466	59.405	59.344	59.283	59.221

Iron Vs. Copper Nickel

J

	19	20	21	22	23	24	25	26	27	28	29	30
-200	-8.857	-8.909	-8.960	-9.012	-9.064	-9.115	-9.167	-9.219	-9.271	-9.322	-9.374	-9.426
-150	-7.466	-7.518	-7.569	-7.621	-7.673	-7.724	-7.776	-7.828	-7.880	-7.931	-7.983	-8.035
-100	-5.599	-5.651	-5.702	-5.754	-5.806	-5.857	-5.909	-5.961	-6.013	-6.064	-6.116	-6.168
-50	-3.398	-3.450	-3.501	-3.553	-3.605	-3.656	-3.708	-3.760	-3.812	-3.863	-3.915	-3.967
0	-0.967	-1.019	-1.070	-1.122	-1.174	-1.225	-1.277	-1.329	-1.381	-1.432	-1.484	-1.536
50	1.618	1.566	1.515	1.463	1.411	1.360	1.308	1.256	1.204	1.153	1.101	1.049
100	4.301	4.249	4.198	4.146	4.094	4.043	3.991	3.939	3.887	3.836	3.784	3.732
150	7.041	6.989	6.938	6.886	6.834	6.783	6.731	6.679	6.627	6.576	6.524	6.472
200	9.810	9.758	9.707	9.655	9.603	9.552	9.500	9.448	9.396	9.345	9.293	9.241
300	15.358	15.306	15.255	15.203	15.151	15.100	15.048	14.996	14.944	14.893	14.841	14.789
400	20.879	20.827	20.776	20.724	20.672	20.621	20.569	20.517	20.465	20.414	20.362	20.310
500	26.421	26.369	26.318	26.266	26.214	26.163	26.111	26.059	26.007	25.956	25.904	25.852
600	32.129	32.077	32.026	31.974	31.922	31.871	31.819	31.767	31.715	31.664	31.612	31.560
700	38.163	38.111	38.060	38.008	37.956	37.905	37.853	37.801	37.749	37.698	37.646	37.594

LIST OF REPLACEABLE PARTS

REF	DESCRIPTION	PARTS NO.	QTY
1	Power switch	RP001-HL600	1
2	Key board	RP002-HL600	1
3	Model name label	RP003-HL600	1
4	Case (front)	RP004-HL600	1
5	LCD holder	RP005-HL600	1
6	LCD display plate	RP006-HL600	1
7	LCD drive conductor	RP007-HL600	2
8	P.C. board	RP008-HL600	1
9	Input jack holder	RP009-HL600	1
10	Input jack with cold junction	RP010-HL600	1
11	Battery power cable	RP011-HL600	1
12	Case (back)	RP012-HL600	1
13	Hand strap	RP013-HL600	1
14	Battery compartment cover	RP014-HL600	1
15	Instruction label	RP015-HL600	1
16	Dry battery	RP016-HL600	4
17	Battery holding spring	RP017-HL600	5
18	Screw	RP018-HL600	4
19	Rugged Protective Case	RP900-HL600	1
20	Packing Case	RP901-HL600	1
21	Instruction Manual	RP902-HL600	1

■ How to obtain parts

To ensure prompt and efficient handling of your order, please include the following information.

1. Parts No.
2. Description
3. Quantity
4. Instrument model and serial number.

INTERCHANGEABLE THERMOCOUPLE PROBES

Standard Surface Probes

Model 101 (C101)
For stationary surfaces.
500 °C max. t(99)=2 sec

Model 111 (C111)
For stationary surfaces
500 °C max. t(99)=2 sec

Model 112 (C112)
For stationary surfaces
500 °C max. t(99)=2 sec

Model 113 (C113)
For stationary frangible surfaces
400 °C max. Glass Teflon guarded.
t(99)=2 sec

Model 330 (C330)
For stationary surfaces
800 °C max. t(99)=2 sec

Small Surface Probes

Model 353 (C353)
For stationary small surface areas
400 °C max. t(99)=1 sec

Model 124 (C124)
For stationary surfaces
250 °C max. Magnetic supporting.
t(99)=1 sec

Model 126 (C126)
For stationary surfaces
300 °C max. t(99)=0.6 sec
Most precise and quick response.

Moving Surface Probes

Model 201 (C201)

For moving surfaces

250 °C max. Teflon guarded.
t(99)=3 sec

Model 211 (C211)

Heavy duty moving surfaces probe

200 °C max. t(99)=5 sec

Model 423 (C423)

Roll bearings model

200 °C max. t(99)=2 sec

Penetration Probe

Model 526 (C526)

Mini Hypodermic probe

200 °C max. t(99)=1 sec

Model 513 (C513)

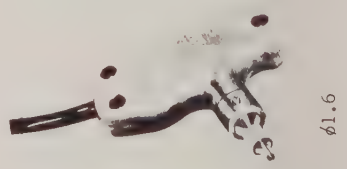
General purpose penetration probe

500 °C max. t(99)=2 sec

Model 701 (C701)

Heavy duty penetration probe

300 °C max. t(99)=3 sec



Air (Gas) Probe

Model 510 (C510)
General purpose air probe
500 °C max. t(99)=4 sec

Flat Leaf Probe

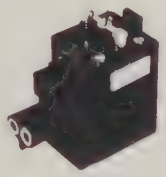
Model 529 (C529)
Thin flat leaf probe
200 °C max. t(99)=1 sec

Oil Tank Probe

Model 530 (C530)
50m of strong extension cable is available.
250°C max. t(99)=4 sec

Soldering Iron Probe

Model 754 (C754)
Soldering iron probe
500 °C max. t(99)=4 sec



Heavy Duty Surface Probe

Model 619 (C619)
Heavy duty surface probe
700 to 1200 °C t(99)=10 sec

I N D E X

A
About This Model, 1-1
Accessories, 1-1
Accuracy, 1-2
Air (Gas) Probe, 7-3
Architecture, 4-2
Auto-fullscale, 4-2
Auto-zero, 4-2
Average, 2-6, 4-5
Average Select Key, 1-3, 2-6

B
Battery Installation, 2-1
Battery Level Indication, 2-2
Battery Pack, 2-3
Block Diagram, 4-2
Boiling Temperature Table, 5-3
Burnout Indicator, 2-5

C
Calibration Probe, 5-1
Calibration Test, 5-4
Centigrade, 2-5
Centigrade/Fahrenheit, 2-5
Charger, 2-2
Charger Jack, 1-3
Connections for dc
  voltage standard, 5-4

D
DC VOLTAGE STANDARD, 5-1
Digital Linearization, 4-4
Dimensions, 1-2
Display, 1-2, 1-3
Display Test, 5-2

E
Environmental Limits, 1-2

F
Fahrenheit, 2-5
Fixed Point Test, 5-2
Flat Leaf probe, 7-3
Functions, 1-2
FULL, 2-1

G
Gas, 3-3

H
Hand Strap, 1-3
Heavy Duty Surface Probe, 7-3
Hold, 2-6
Hold Key, 1-3, 2-6
House Current, 2-3
How to obtain parts, 6-1
How to use (a surface probe), 3-2

I
Illuminator On, 2-5
Interchangeable
  thermocouple probe, 7-1
INTRODUCTION AND
  SPECIFICATIONS, 1-1

K
Key Board Test, 5-2

L
LCD segments, 2-4
Liquid, 3-2
List of replaceable parts, 6-1

M
MAINTENANCE, 5-1
Maximum Input Voltage, 1-2
MEASUREMENT TUTORIAL, 3-1
Moving Surface Probes, 7-2

N
Ni-Cd Battery Pack, 2-1

O
Oil Tank Probe, 7-3
OPERATING INSTRUCTIONS, 2-1
Option, 1-1
Or (Overrange Indicator), 2-3
Other Power Sources, 2-3
Overrange Indicator, 2-5

P
Peak Valley Hold, 2-6, 4-5
Peak Hold Key, 1-3
Penetration Probe, 7-2
Performance Test, 5-1
Power-On, 2-3
Power Supply, 1-2
Power Switch, 1-3, 2-4
Preparation for Test, 5-2
Probe Installation, 2-3

R
Range, 1-1
Reading Rate, 1-2
Recommended Equipment, 5-1
Reference Table, 5-5
Replaceable Parts, 6-1
Resolution, 2-6
Resolution Select Key, 1-3, 2-6

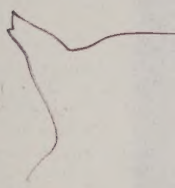
S
Scan Timing, 4-4
Seebeck Effect, 4-1
Self-calibration, 4-2
Self-Test, 2-3
Soldering Iron Probe, 7-3
Solid, 3-3
Specifications, 1-1
Standard Surface Probes, 7-1
Surface Probes, 7-1
Surface Temperature, 3-1

T
Temperature Coefficient, 1-2
Thermocouple Input Jack, 1-3
Timing Chart, 4-4
TRICKEL, 2-1

U
Unpacking and Repacking, 2-1

V
Valley Hold, 2-4, 4-5
Voltage/Frequency Converter, 4-4

W
Weight, 1-2



ANRITSU METER CO.,LTD.

2-4-5 Shimomeguro Meguro-ku Tokyo 153, Japan
Phone : 81-3-491-9181
Telefax : 81-3-493-6729
Telex : ANRITUM J 29317

MP MASTER
MA35798